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Notification of reason for refusal

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Applied Articles of Laws	29(2)

This application shall be refused because of the following reason. If there is any opinion about this, a statement of your arguments should be submitted within 60 days from the date of sending the Notification of reason for refusal.

Reasons

A. A patent relating the claims 1 to 15 shall not be granted under Section 29(2). Because the invention could easily have been made, prior to the filing of the patent application, by a person with ordinary skill in the art to which the invention pertains, on the basis of the invention which were described in the following publication 1 and 2 distributed in Japan or else where prior to the filing of the patent application.

Remarks

1. TOKUKAIHEI 03-035637 (Reference to Fig.1 and Figs. 10-16)
2. TOKUKAIHEI 06-085830 (Reference to Fig. 12)

(A Note)

The "Management Table" described in the above publication 1 corresponds to the "ATM address table" of the claimed invention. The above publication 1 does not describe to transfer Inquiry demands of the ATM address to all the terminals through the ATM exchange when the ATM address is not obtained by the ATM address table. However, in transferring Inquiry demand, there are not particular difficulties.

The above publication 2 describes a broadcast technique every group.

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拒絶理由通知書

特許出願の番号	平成　６年　特許願　第１５３３８１号
起案日	平成１４年　４月３０日
特許庁審査官	小林　紀和　　４２４０　５Ｘ００
特許出願人代理人	斉藤　千幹　様
適用条文	第２９条第２項

この出願は、次の理由によって拒絶をすべきものである。これについて意見があれば、この通知書の発送の日から６０日以内に意見書を提出して下さい。

理　由

A. この出願の請求項　１－１５　に係る発明は、その出願前日本国内又は外国において頒布された下記　１，２　の刊行物に記載された発明に基いて、その出願前にその発明の属する技術の分野における通常の知識を有する者が容易に発明をすることができたものであるから、特許法第２９条第２項の規定により特許を受けることができない。

記

１．特開平０３－０３５６３７号公報（第１，１０－１６図を参照。）

２．特開平０６－０８５８３０号公報（図１２を参照。）

（備考）

上記刊行物１に記載された「管理テーブル」は、本願発明の「ＡＴＭアドレステーブル」に相当する。

上記刊行物１には、ＡＴＭアドレスがＡＴＭアドレステーブルより求まらないときに、ＡＴＭアドレス問い合わせ要求をＡＴＭ交換機を介して全端末に転送する点は記載されていないものの、その点には、格別な困難性は認められない。

上記刊行物２には、グループ毎に同報する技術が記載されている。

先行技術文献調査結果の記録

・調査した技術分野

国際特許分類第７版（IPC 7）：H04L 12/56

Ｆタームテーマ　：　5K030（広域データ交換）

この先行技術文献調査の記録は、拒絶理由を構成するものではない。

この拒絶理由通知書の内容等に関する問い合わせ先

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Description

1. Title of the Invention

Transmission Control System in ATM Network

2. Claims

1. In a system for transmitting data between a plurality of terminal devices (1-1 to 1-n) in asynchronous transfer mode via an exchange network (3) by accommodating said plurality of terminal devices (1-1 to 1-n) in said exchange network (3) in asynchronous transfer mode via internal or external terminal adaptors (2-1 to 2-n),

a transmission control system in an ATM network comprising a management table (4) for managing virtual paths of said exchange network (3) and a table controlling section (5) for controlling said management table (4), and characterized in that:

said table controlling section (5) searches whether a virtual path corresponding to a communication request from said terminal device (1-1 to 1-n) has been set in said management table (4), and if the virtual path has been set, data from said terminal device which requested communication is transmitted in asynchronous transfer mode via said virtual path, and if the virtual path has not been set, then a virtual path corresponding to said communication request is set in said management table (4) and said data is transmitted in asynchronous mode by said virtual path, and the virtual path set in said management table (4) is cleared under a predetermined condition.

2. The transmission control system in an ATM network according to Claim 1, characterized in that said management table (4) and table controlling section (5) are installed in said terminal adaptor (2-1 to 2-n), and the virtual path is set or cleared for said management table (4) by said table controlling section (5) based on the exchange of control information with said exchange network (3).

3. The transmission control system in an ATM network according to Claim 1, characterized in that said management table (4) and table controlling section (5) are installed in said exchange network (3), the virtual path is set in said management table (4) by said table controlling section (5) corresponding to the communication request from said terminal device (1-1 to 1-n), and the virtual path is cleared under a predetermined condition.

4. The transmission control system in an ATM network according to Claim 1, characterized in that said table controlling section (5) clears the virtual path set in said management table (4) unconditionally at each predetermined time or under a condition where time, which has elapsed from the time the virtual path was used last, becomes long.

3. Detailed Description of the Invention

[Summary]

The present invention relates to a transmission control system in an ATM network for transmitting data in asynchronous transfer mode, where an object is to smoothly perform data transmission between terminal devices by setting the virtual path of an exchange network dynamically, and the present invention is a system for transmitting data between a plurality of terminal devices in asynchronous mode

via an exchange network by accommodating the plurality of terminal devices in the exchange network in asynchronous transfer mode via internal or external adaptors, comprising a management table for managing a virtual path of the exchange network and a table controlling system for controlling the management table, wherein the table controlling section searches whether a virtual path corresponding to a communication request from the terminal device has been set in the management table, and if the virtual path has been set, data from the terminal device which requested communication is transmitted in asynchronous transfer mode via the virtual path, and if the virtual path has not been set, then a virtual path corresponding to the communication request is set in the management table, and the data is transmitted in asynchronous mode by this virtual path, and the virtual path set in the management table is cleared.

[Industrial Field of Application]

The present invention relates to a transmission control system in an ATM network for transmitting data in asynchronous transfer mode.

The asynchronous transfer mode (ATM) is for transmitting cells which are generated by dividing data into

a predetermined length, each of which has a header added, and various exchange networks in asynchronous transfer mode (hereafter "ATM network") are proposed. Such an ATM network is configured based on the connection service. Therefore an ATM network has the advantages of line exchange and packet exchange, but implementing such a connectionless service as packet exchange is a consideration.

[Prior Art]

An ATM network is based on the connection service just like a line exchange, as mentioned above, whereas to implement a connectionless service, one possibility is to set virtual paths in the ATM network in advance. For example, as Fig. 17 shows, a handler 62 is installed in the ATM network 63, and the net addresses of the terminal devices 61-1 to 61-n accommodated in the ATM network (63) (terminal adaptors for dividing data into a predetermined length to generate cells or to perform the processing in reverse thereof are omitted here for simplification) and the virtual paths corresponding to the terminal devices are set by the network management function, and the virtual path number of the local terminal device is set in each terminal device 61-1 to 61-n.

The terminal device divides the data which includes the net address of the remote terminal device into cells using

the virtual path number assigned to the local terminal device, and sends the cells to the handler 62 via the ATM network 63. The handler 62 assembles the received cells, identifies the net address of the remote terminal device, searches the virtual path based on this net address, disassembles the data back into cells again using the virtual path number, and sends the cells to the remote terminal device via the ATM network 63.

By such a configuration, data can be transferred between the terminal devices using cells via the ATM network 63 in the connectionless service similar to the packet exchange system.

In Fig. 18, the handler is not installed in the ATM network 55, and virtual paths, such as the virtual paths indicated by dotted lines, are set for terminal devices 64-1 to 64-n to connect with other terminal devices with which communications are possible. This system is equivalent to the system where the function of the handler (62) is distributed to each terminal device 64-1 to 64-n. By setting the virtual paths in advance in this way, data can be divided into cells and be transmitted as cells by a connectionless service.

[Problems that the Invention is to Solve]

By setting the virtual paths as described above, data can be divided into cells and be transmitted between the terminal devices via the ATM networks 62 and 65 by a connectionless service.

However, in the case of a system where a handler 62 is installed, as shown in Fig. 17, the virtual paths for the number of the terminal devices 61-1 to 61-n accommodated in the ATM network 63 must be set in advance, and the number of virtual paths must be increased as terminal devices are added. Since the number of virtual paths is limited, the number of terminal devices to be accommodated is also limited. Also even if a terminal device, which is rarely used, is accommodated, a virtual path is allocated to the terminal device, which makes the use of the ATM network inefficient.

Also the handler 62 requires the process of setting or clearing of a virtual path when a terminal device is added or removed, and cells are assembled or disassembled in the handler 62, so the handler requires a very large processing capability, which makes the system expensive.

In the case of the system where virtual paths are set corresponding to the terminal device 64-1 to 64-n shown in Fig. 18, virtual paths are set in advance for terminal devices which have the possibility to perform communication,

but if the number of terminal devices which have the possibility to perform communication is high, and the number of terminal devices accommodated in the ATM network 65 is high, the virtual paths are set like a net, and in this case as well, the number of virtual paths is limited, so the number of terminal devices to be accommodated is also limited.

Also to add or remove a terminal device, it is necessary to notify the setting or clearing of the virtual path to the terminal devices which could possibly communicate with this terminal device to be added or removed, which increases the processing load of the terminal devices.

With the foregoing in view, it is an object of the present invention to smoothly execute data transmission between terminal devices by setting the virtual paths of the exchange network dynamically.

[Means of Solving the Problems]

The transmission control system in the ATM network of the present invention is for executing data transmission between terminal devices via the ATM network based on the connectionless service, which will now be described with reference to Fig. 1.

In a system for transmitting data between terminal devices 1-1 to 1-n in asynchronous transfer mode via an

exchange network 3 by accommodating the plurality of terminal device 1-1 to 1-n in the exchange network 3 in asynchronous transfer mode via terminal adaptors 2-1 to 2-n, a management table 4 for managing virtual paths of the exchange network 3 and a table controlling section 5 for controlling the management table 4 are installed in the terminal adaptor or in the exchange network, the table controlling section 5 searches whether the virtual path corresponding to a communication request from the terminal devices 1-1 to 1-n has been set in the management table 4, and if the virtual path has been set, data from the terminal device which requested communication is transmitted in asynchronous transfer mode using this virtual path, and if the virtual path has not been set, then a virtual path corresponding to the communication request is set in the management table 4, and the data from the terminal device which requested communication is disassembled into cells and is transmitted in asynchronous mode using that virtual path, and the virtual path set in the management table 4 is cleared under a predetermined condition, such as the elapse of a predetermined time.

If the terminal device has the function of the terminal adaptor, the configuration may be 1'-n, indicated by the chain line in Fig. 1.

[Functions]

The management table 4 assigns correspondence between the net address and the virtual path, and manages the net address and virtual path, and the table controlling section 5 searches the management table 4 and sets and clears a virtual path. For example, the table controlling section 5 searches whether a virtual path has been set using the net address of the remote terminal device corresponding to a communication request, and if not set, a virtual path is set in the management table 4, the data from the terminal device which requested communication is disassembled into cells, and is sent to the exchange network 3 using this virtual path. Therefore a new path can be set for transmitting data without setting a fixed virtual path in advance.

The virtual path set in the management table 4 is cleared under a predetermined condition. This predetermined condition is, for example, clearing the virtual path unconditionally at each predetermined time, or clearing the virtual path for which an elapsed time, from the time when this path was used last, is long at each predetermined time.

Since a virtual path can be dynamically set and the virtual path which is rarely used can be cleared, virtual paths can be effectively used.

[Embodiments]

Embodiments of the present invention will now be described with reference to the accompanying drawings.

Fig. 2 is a block diagram depicting an embodiment of the present invention, wherein 11 is a terminal device, 12 is a terminal adaptor, 13 is an ATM network, 20 and 22 are ADP processing sections for executing processing of an adaptive layer, 21 is a signal processing section, 23 is an ATM processing section for disassembling and assembling cells, 24 is a physical layer processing section for executing the level conversion of transmission/reception signals and the inter-conversion of light signals and electrical signals when optical transmission line is used, 25 is a table processing section, 26 is a table controlling section, 27 is a management table, 28 is a search processing section, and 29 is a setting/clearing processing section.

This embodiment shows the case when the management table 27 and the table controlling section 26 are installed in the terminal adaptor 12, and the table controlling section 26 is comprised of the search processing section 28 for searching the virtual paths set in the management table 27, and the setting/clearing processing section 29 for controlling the setting and clearing of a virtual path. The management table 27 has an area for setting the correspondence of a net address AD, virtual path number VCI,

and time T, and a virtual path is set or cleared by control of the setting/clearing processing section 29. Time T indicates the time the virtual path is used, and can be used, for example, for clearing a virtual path when an elapsed time, from the time when the virtual path was used last, exceeds the threshold. Instead of time T, the number of times the virtual path was used during a predetermined time can also be used for clearing a path. It is also possible to set the virtual path by attaching such a condition as "clearing disabled".

When the terminal device 11 sends data with a net address of the remote terminal to the terminal adaptor 12, the ADP processing section 20 transfers the net address to the table processing section 27, and the table processing section 27 searches the management table 27 by the search processing section 28, and if a virtual path corresponding to the net address has been set, the table processing section 27 transfers the virtual path number to the ATM processing section 23. The ADP processing section 20 disassembles the data into cells, attaches a header for indicating the disassembly sequence number to the cells, and transfers the data to the ATM processing section 23, the ATM processing section 23 inserts the virtual path number into the header part of the disassembled cell, and sends the

cells from the physical layer processing section 24 to the ATM network 13.

When a net address of the remote terminal has not been registered in the management table 27 and a target virtual path has not been set in the network, the table processing section 25 sends a virtual path setting request to the signal processing section 21, and a virtual path number corresponding to the net address of the remote terminal device is determined by the control of the signal processing section 21 or the transmission/reception of information to/from the ATM network 13, and is notified to the table processing section 25. The network sends the virtual path setting request information to the remote terminal device. The table processing section 25 sets a virtual path number VCI corresponding to the net address AD of the remote terminal device in the management table 27 using the setting/clearing processing section 29, and notifies this virtual path number VCI to the ATM processing section 23. By this, the ATM processing section 23 inserts the virtual path number into the header section of the cell, and sends the cells to the ATM network 13 via the physical layer processing section 24.

When the virtual path setting request information is received from the ATM network 13, the signal processing

section 21 analyzes the virtual path setting request information, transfers the net address and virtual path to the table processing section 25, and the setting/clearing processing section 29 sets the virtual path in the management table 27.

The virtual path set in the management table 27 is cleared under a predetermined condition, for example, a timer is installed in the table managing section 25 or signal processing section 21, and the setting/clearing processing section 29 clears the virtual path set in the management table 27 unconditionally at each predetermined time based on this timer, or clears the virtual path when the time elapsed, from the time when the virtual path was used last to the current time, is a predetermined time or more, at time T. Or if the number of times of use is counted, the setting/clearing processing section 29 clears the virtual path under a condition when this value is a predetermined value or less. Or when the setting/clearing processing section 29 identifies that the area of the management table 27 is insufficient, the setting/clearing processing section 29 unconditionally clears a virtual path for which a predetermined time has elapsed since last used, or for which the number of times of use is a predetermined value or less. Or when the number of remaining virtual

paths of the ATM network 13 is insufficient, and a new virtual path cannot be set, the setting/clearing processing section 29 unconditionally clears a virtual path or clears a virtual path for which a predetermined time has elapsed since last used, or for which the number of times of use is a predetermined value or less.

If the condition is "clearing disabled" when clearing a virtual path, significant virtual paths can always be secured by not clearing virtual paths.

Therefore virtual paths are dynamically set in the management table 27, and the virtual paths of ATM network 13 can be efficiently used.

Fig. 3 is a flow chart of an embodiment of the present invention, and shows the processing in the table processing section 25. "Idle" is a state when the table processing section 25 is waiting for the next processing, and when the ADP processing section 20 notifies the net address of the remote terminal [1], the table processing section 25 searches the management table 27 using the search processing section 28 [2], judges whether a virtual path has been set [3], and if set, the table processing section 25 notifies the virtual path number to the ATM processing section 23 as a VCI value notification [4].

If the virtual path has not been set, the table processing section 25 sends the virtual path setting request corresponding to the net address of the remote terminal to the signal processing section 21 [5]. The signal processing section 21 determines the virtual path corresponding to the net address of the remote terminal internally or by exchanging information with the ATM network 13, and notifies the table processing section 25 that the virtual path is now set. So when the table processing section 25 receives the net address of the remote terminal and VCI value (virtual path number) [6], the table processing section 25 notifies the virtual path number to the ATM processing section 23 [7], and registers the virtual path to the management table 27 [8].

When a virtual path setting request information is received from the remote terminal device via the network, the signal processing section 21 analyzes the request information and the table processing section 25 receives the net address of the remote terminal and the VCI value from the signal processing section 21 based on the analysis result [9], and registers the virtual path in the management table 27 by the control of the setting/clearing processing section 29 [10].

Fig. 4 is a flow chart of unconditional clearing according to an embodiment of the present invention, and as described above, when time is set in a timer installed in the table processing section 25 or signal processing section 21, and the table processing section 25 receives notice that the timer is up [11], clearing the virtual path to one net address set in the management table 27 is requested using the control of the setting/clearing processing section 29 [12], the table processing section 25 deletes the virtual path from the management table 27 [13], judges whether deletion of all the virtual paths of the management table 27 is over [14], and if over, the table processing section 25 sets the timer [15] and waits for the next processing until the timer is up the next time [11].

When the signal processing section 21 identifies the reception of the virtual path clearing request information, and the table processing section 25 receives the virtual path clearing request [18], the table processing section 25 clears the virtual path requested from the management table 27 using control by the setting/clearing processing section 29 [17].

Fig. 5 and Fig. 6 show the processing of the terminal adaptor and the processing at the network side when a virtual path is cleared based on time monitored at the ATM

network side, where the management table 27 of the terminal adaptor 12 is a table where the net address AD of a terminal device and virtual path number VCI are assigned correspondence and are registered, and the table where the virtual path number VCI and time T are assigned correspondence and are registered, and the timer, are installed at the ATM network side 13, and when the timer is up [20] the ATM network side sends a virtual path clearing notice [21], as Fig. 6 shows. In this case, the ATM network side judges whether the time between the time the virtual path was used last T and the current time exceeds the threshold, and sends a clearing notice if time was exceeded. And the ATM network side deletes the virtual path number VCI and time T from the table [22], judges whether the processing for the virtual path on the table is over [23], and if over, the ATM network side sets the timer [24], and waits for the next processing until the timer is up the next time.

When the terminal adaptor 12 receives the virtual path clearing notice [18], the terminal adaptor 12 deletes the net address AD of the remote terminal and virtual path number VCI corresponding thereto from the table [19].

In this case, the network side monitors time, and uses the elapsed time since the time the virtual path was used

last as the clearing condition, but the number of times the virtual path was used can also be used as the condition.

Fig. 7 to Fig. 9 are diagrams depicting the operation of an embodiment of the present invention, and Fig. 7 shows the case when the terminal devices TE1 and TE2 are accommodated in the ATM network via the terminal adaptors TA1 and TA2 respectively, the net address of the remote terminal AD2, the virtual path value number VCI12 and the time when the virtual path was used last t1 are registered in the management table 27-1 of the remote adaptor TA1, and the net address of the remote terminal AD1, the virtual path number VCI21 and the time when the virtual path was used last t2 are registered in the management table 27-2 of the terminal adaptor TA2.

When data is sent from the terminal device TE1 to the terminal device TE2, the terminal adaptor TA1 searches the table, and since the net address of the remote terminal device AD2 and the virtual path number VCI12 are set in the management table 27-1, as mentioned above, the terminal adaptor TA1 immediately disassembles the data into cells, adds the virtual path number VCI12 to the headers thereof, sends the cells to the ATM network, and sets the time when all the cells were sent out as the time when the virtual path was used last t3.

The terminal adaptor TA2 which received the cells via the ATM network assembles the cells into data, transfers the data to the terminal device TE2, and sets the time when the virtual path was used last t4. Therefore the content of the management tables 27-1 and 27-2 becomes the content shown in the lower part of the diagram.

When data is sent from the terminal device TE1 to the terminal device TE3, as shown in Fig. 8, the terminal adaptor TA1 searches the table, as mentioned above. In this case, a virtual path connecting the terminal adaptors TA1 and TA3 has not been set in the network, that is, unlike the above mentioned case, the data indicating that the virtual path (net address of the remote side and VCI value) has not been set in the management tables 27-1 and 27-3, so the terminal adaptor TA1 sends a VP (virtual path) setting request to the ATM network.

The ATM network sets the VP by selecting an open VP, notifies the setting of the VP to the terminal adaptors TA1 and TA3, the terminal adaptors TA1 and TA3 set the VP in the management tables 27-1 and 27-3, the terminal adaptor TA1 disassembles the data from the terminal device TE1 into cells, and sends the cells to the ATM network, sets the time when all the cells were sent out as the time when the virtual path was used last t5, and the terminal adaptor TA3

assembles the cells into data, transfers the data to the terminal device TE3, and sets the time when the virtual path was used last t6 in the management table 27-3. Therefore, as shown in the lower part of the diagram, the net address of the terminal AD3, the virtual path number VCI13 and the time when the virtual path was used last t5 are registered in the management table 27-1, and the net address of the terminal AD1, the virtual path number VCI31, and the time when the virtual path was used last t6 are registered in the management table 27-3.

Fig. 9 shows the case when the management table 27-2 of the terminal adaptor TA2 is inspected and the terminal adaptor TA2 has sent the VP clearing request, since the time elapsed from the time when the VP to the terminal device TE1 was used last is long, and when the terminal adaptor TA2 sends a VP clearing request to the ATM network, the ATM network sends the VP clearing notice to the terminal adaptors TA1 and TA3, so the content corresponding to the VP clearing notice is deleted from the management tables 27-1 and 27-3 of the terminal adaptors TA1 and TA3. Therefore the content of the VP between the terminal devices TE1 and TE2 is deleted from the management tables 27-1 and 27-3, as shown in the lower part of the diagram, which shows that the VP has been deleted.

Fig. 10 is a block diagram depicting another embodiment of the present invention, where the management table is installed at the network side. In Fig. 10, 31 is a terminal device, 32 is a terminal adaptor, and 33 is a network controlling section. The terminal adaptor 32 has a configuration which is equivalent to the configuration when the table processing section 25 is omitted from the terminal adaptor 12 in Fig. 2, where 40 and 42 are ADP processing sections, 41 is a signal processing section, 43 is an ATM processing section, and 44 is a physical layer processing section.

The network controlling section 33 is disposed at an arbitrary position of the ATM network, comprising a physical layer processing section 50, ATM processing section 51, ADP processing section 52, signal processing section 53 and table processing section 54, and the table processing section 54 is comprised of a management table 56 and a table controlling section 55, and the table controlling section 55 is further comprised of a search processing section 57 and a setting/clearing processing section 58.

Fig. 11 is a flow chart depicting the embodiment shown in Fig. 10, where the search and setting operation of the management table 56 of the table processing section 54 is shown.

When the table processing section 54 receives the net address of a remote terminal from the signal processing section 53 [1], the table processing section 54 searches the management table 56 [2], judges whether the virtual path has been set [3], and if set, the table processing section 54 notifies the VCI value (virtual path number) thereof to the signal processing section 53 [4]. If not set, the table processing section 54 requests to set the VP corresponding to the net address of the remote terminal [5], and when the net address of the remote terminal and the VCI value are notified [6], the table processing section 54 notifies the VCI value thereof to the signal processing section 53 [7], and registers the VCI value in the management table 56 [8].

As mentioned above, when communication to a terminal device, which is not set in the management table 56, is requested, a virtual path can be set and cells can be transmitted using the virtual path via the ATM network.

Fig. 12 is a flow chart in the case of the unconditional clearing of a virtual path, where when the timer is up [11] or when the clearing of a virtual path is requested [16], the clearing of the virtual path to be cleared is notified [12], and the virtual path according to the clearing notice is deleted from the management table 56 by the control of the setting/clearing processing section 58

[13]. Then the table processing section 54 judges whether deletion is over for the entire management table 56 [14], and if over, the table processing section 54 sets the timer [15] and waits for the next processing until the next timer is up.

Fig. 13 is a flow chart of conditional clearing where when the timer is up [21] or virtual path clearing is requested [22], the table processing section 54 judges whether time, from the time when the virtual path was used last to the current time, exceeds a threshold in the area at time T for one virtual path of the management table 56 [23]. If not exceeded, the table processing section 54 judges whether processing for the entire area of the management table 56 has been completed [26]. If exceeded, the table processing section 54 notifies the clearing of the virtual path [25], clears the virtual path from the management table 56, and judges whether processing ended [26]. If ended, the table processing section 54 sets the timer [27], and waits for the next processing until the timer is up.

Fig. 14 is a diagram depicting the operation according to another embodiment of the present invention, and when the net address of the terminal AD2, virtual path number VCI12, and time when the virtual path was used last t11 are registered in the management table 56-1 of the terminal

adaptor TA1 supporting section of the ATM network, and the net address of the terminal AD1, virtual path number VCI21 and time when the virtual path was used last 12 are registered in the management table 56-2 of the terminal adaptor TA2 supporting section, the data is sent from the terminal device TE1 to the terminal adaptor TA1, and the terminal adaptor TA1 sends the VCI value (virtual path number) notification request to the ATM network using a call setting message. The ATM network searches the table, and since the target VCI value has been registered in the management table 56-1, the ATM network notifies the VCI value to the terminal adaptor TA1. The terminal adaptor TA1 generates cells where the VCI value is inserted in the header sections, and sends the cells to the ATM network.

The terminal adaptor TA2 receives the cells, assembles the cells into data, and sends the data to the terminal device TE2. And the terminal adaptor TA2 monitors whether a predetermined time or more has elapsed by the passing time of the cells, and if the cell is judged as the last cell, the ATM network sets this time as the end of transmission of all the cells. So in the management tables 56-1 and 56-2, time when the virtual path was used last is updated to be t13 and t14, as shown in the lower part of the diagram.

Fig. 15 shows the case when the virtual path is not set between the terminal adaptors TA1 and TA3, where if data is sent from the terminal device TE1 to the terminal device TE3 when no data corresponding to the virtual path has been set in the management table 56-3 of the terminal adaptor TA3 supporting section, as shown in the upper part of the diagram, then the terminal adaptor TA1 sends the VCI notification request to the ATM network using a call setting message, for example, just like the above mentioned case. The ATM network searches the table, and sets the VP (virtual path) since a virtual path is not set, sets the VP in the management tables 56-1 and 56-3, and notifies the VCI to the terminal adaptor TA1.

The terminal adaptor TA1 generates cells where this VCI value is inserted in the header part, just like the above mentioned case, and sends the cells to the ATM network. The terminal adaptor TA3 sends the data as assembled cells to the terminal device TE3. When the ATM network judges the end of transmission of all the cells by monitoring the timer, as mentioned above, the ATM network sets the time. Therefore the net address of the terminal AD3, virtual path number VCI 13, and time when the virtual path was used last t15 are registered in the management table 56-1, and the net address of the terminal AD1, virtual path number VCI 31, and

the time when the virtual path was used last t16 are registered in the management table 56-3.

Fig. 16 shows the virtual path clearing operation, where when the content of the management tables 56-1 and 56-2 is as shown in the upper part of the diagram, the ATM network inspects the management tables, extracts the virtual paths for which the elapsed time, from the time when the virtual path was used last to the current time, exceeds the threshold, clears the VP, and deletes the VP from the management tables. For example, when the elapsed times, from the time when the virtual path was used last, t13 and t14, to the current time, exceeds the threshold, the content of the management tables 56-1 and 56-2 become as shown below in the lower part of the diagram by table delete processing, and the virtual path between the terminal devices TE1 and TE2 is thereby cleared.

The present invention is not limited by the above mentioned embodiments, but can be added to or modified in various ways, and, for example, when the management table 56 is installed at the network side, the area of the management table for each terminal adaptor supporting section is monitored, and a virtual path for which the elapsed time, from the time when the virtual path was used last, is long, or a virtual path for which the frequency of use is low when

the number of virtual paths being set is a predetermined value or more, can be the candidate of a virtual path to be cleared.

[Effect of the Invention]

As described above, according to the present invention, the table controlling section 5 searches whether the virtual path corresponding to the communication request from the terminal device has been set in the management table 4 for managing the virtual paths of the exchange network 3, and if not set, the virtual path is set, and the virtual path being set in the management table 4 is cleared under a predetermined condition, and since the virtual path can be dynamically set, data can be transmitted by a connectionless service in an exchange network 3 based on the connection service, and the virtual paths of the exchange network 3, in this case, can be effectively used.

Management table 4 and the table controlling section 5 are installed in the terminal adaptor, and virtual paths can be distributedly managed, so the processing burden on the exchange network 3 is decreased, and processing required for adding or removing a terminal device can be simplified.

If the management table 4 and the table controlling section 5 are installed in the exchange network 3, virtual

paths can be centrally managed, and virtual path clearing processing can be simplified.

If a virtual path is unconditionally cleared at each predetermined time, the clearing processing is very simplified, and if clearing is executed when the elapsed time from the time when the virtual path was used last is a predetermined value or more, a virtual path to a terminal device where communication has not been executed for a long time can be cleared, so virtual paths can be effectively used.

4. Brief Description of the Drawings

Fig. 1 is a diagram depicting the principle of the present invention;

Fig. 2 is a block diagram depicting an embodiment of the present invention;

Fig. 3 is a flow chart depicting an embodiment of the present invention;

Fig. 4 is a flow chart depicting unconditional clearing according to an embodiment of the present invention;

Fig. 5 is a flow chart depicting the processing by the terminal adaptor;

Fig. 6 is a flow chart depicting processing by the network side;

Fig. 7 to Fig. 9 are diagrams depicting operation of an embodiment of the present invention;

Fig. 10 is a block diagram depicting another embodiment of the present invention;

Fig. 11 is a flow chart depicting another embodiment of the present invention;

Fig. 12 is a flow chart depicting unconditional clearing according to another embodiment of the present invention;

Fig. 13 is a flow chart depicting conditional clearing according to another embodiment of the present invention;

Fig. 14 to Fig. 16 are diagrams depicting operation of another embodiment of the present invention;

Fig. 17 is a diagram depicting control by the handler; and

Fig. 18 is a diagram depicting control by the terminal side.

1-1 to 1-n are terminal devices, 2-1 to 2-n are terminal adaptors, 3 is an exchange network, 4 is a management table, and 5 is a table controlling section.

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FIG. 1 PRINCIPLE OF PRESENT INVENTION

1-1 TERMINAL DEVICE

1-2 TERMINAL DEVICE

2-1 TERMINAL ADAPTOR

2-2 TERMINAL ADAPTOR

3 VIRTUAL PATH

A EXCHANGE NETWORK

4 MANAGEMENT TABLE

5 TABLE CONTROLLING SECTION

[BELOW 5] COMMUNICATION REQUEST

1-n TERMINAL DEVICE

2-n TERMINAL ADAPTOR

FIG. 2 BLOCK DIAGRAM OF AN EMBODIMENT OF PRESENT INVENTION

11 TERMINAL DEVICE

20 ADP PROCESSING SECTION

21 SIGNAL PROCESSING SECTION

22 ADP PROCESSING SECTION

23 ATM PROCESSING SECTION

24 PHYSICAL LAYER PROCESSING SECTION

[RIGHT OF 25] CELLS

13 ATM NETWORK

27 MANAGEMENT TABLE

25 TABLE PROCESSING SECTION

28 SEARCH PROCESSING SECTION

29 SETTING/CLEARING PROCESSING SECTION

FIG. 3 FLOW CHART OF AN EMBODIMENT OF PRESENT INVENTION

A IDLE

[1] NET ADDRESS OF REMOTE TERMINAL

[2] SEARCHES TABLE

[3] SEARCH RESULT

[RIGHT OF [3]] NO

[LEFT OR [3]] YES

[4] NOTIFIES VCI VALUE

A IDLE

[5] REQUESTS TO SET VIRTUAL PATH CORRESPONDING TO NET ADDRESS OF REMOTE TERMINAL

[6] NOTIFIES NET ADDRESS OF REMOTE TERMINAL AND VCI VALUE

[7] NOTIFIES VCI VALUE

[8] REGISTERS IN TABLE

A IDLE

[9] NOTIFIES NET ADDRESS OF REMOTE TERMINAL AND VCI VALUE

[10] REGISTERS IN TABLE

A IDLE

FIG. 4 FLOW CHART OF UNCONDITIONAL CLEARING ACCORDING TO AN EMBODIMENT OF PRESENT INVENTION

A IDLE

[11] TIMER IS UP

[12] REQUESTS CLEARING VIRTUAL PATH CORRESPONDING TO ONE NET ADDRESS ON THE TABLE

[13] DELETES FROM TABLE

[14] END

[15] SETS TIMER

A IDLE

[16] REQUESTS CLEARING VIRTUAL PATH CORRESPONDING TO NET ADDRESS OF REMOTE TERMINAL AND VCI VALUE

[17] DELETES FROM TABLE

A IDLE

FIG. 5 FLOW CHART OF PROCESSING BY TERMINAL ADAPTOR

A IDLE

[18] REQUESTS CLEARING VIRTUAL PATH CORRESPONDING TO NET ADDRESS OF REMOTE TERMINAL AND VCI VALUE

[19] DELETES FROM TABLE (AD AND VCI)

A IDLE

FIG. 6 FLOW CHART OF PROCESSING BY NETWORK SIDE

A IDLE

[20] TIMER IS UP

[21] NOTIFIES CLEARING VIRTUAL PATH TO BE CLEARED

[22] DELETES FROM TABLE (VCI AND T)

[23] END

[24] SETS TIMER

A IDLE

FIG. 7 OPERATION OF AN EMBODIMENT OF PRESENT INVENTION

[LEFT TO RIGHT, TOP DOWN]

ATM NETWORK

A DATA

C TABLE SEARCH

B CELL CELL CELL

A DATA

D TIME SET t3

E TIME SET t4

FIG. 9 OPERATION OF AN EMBODIMENT OF PRESENT INVENTION

[LEFT TO RIGHT, TOP DOWN]

A ATM NETWORK

C TABLE SEARCH

B VP CLEARING NOTICE

D VP CLEARING

E VP CLEARING REQUEST

B VP CLEARING NOTICE

F DELETE

F DELETE

FIG. 8 OPERATION OF AN EMBODIMENT OF PRESENT INVENTION

[LEFT TO RIGHT, TOP DOWN]

ATM NETWORK

A DATA

B TABLE SEARCH

C VP SETTING REQUEST

D VP SETTING

E VP SETTING NOTICE

E VP SETTING NOTICE

D VP SETTING

D VP SETTING

F CELL CELL CELL

A DATA

G TIME SETTING t5

H TIME SETTING t6

FIG. 10 BLOCK DIAGRAM OF ANOTHER EMBODIMENT OF PRESENT INVENTION

41 SIGNAL PROCESSING SECTION

42 ADP PROCESSING SECTION

43 ATM PROCESSING SECTION

44 PHYSICAL LAYER PROCESSING SECTION

40 ADP PROCESSING

31 TERMINAL DEVICE

[LEFT OF 50] CELL

50 PHYSICAL LAYER PROCESSING SECTION

51 ATM PROCESSING SECTION

52 ADP PROCESSING SECTION

53 SIGNAL PROCESSING SECTION

55 SEARCHING PROCESSING SECTION

58 SETTING/CLEARING PROCESSING SECTION

FIG. 11 FLOW CHART OF ANOTHER EMBODIMENT OF PRESENT INVENTION

A IDLE

(1) NET ADDRESS OF REMOTE TERMINAL

(2) SEARCHES TABLE

(3) SEARCH RESULT

[LEFT OF (3)] YES

[RIGHT OF (3)] NO

(4) NOTIFIES VCI VALUE

A IDLE

(5) REQUESTS SETTING VP CORRESPONDING TO NET ADDRESS OF REMOTE TERMINAL

(6) NOTIFIES NET ADDRESS OF REMOTE TERMINAL AND VCI VALUE

(7) NOTIFIES VCI VALUE

(8) REGISTERS IN TABLE

A IDLE

FIG. 12 FLOW CHART OF UNCONDITIONAL CLEARING ACCORDING TO ANOTHER EMBODIMENT OF PRESENT INVENTION

A IDLE

(16) REQUESTS CLEARING OF VIRTUAL PATH

(11) TIMER IS UP

(12) NOTIFIES CLEARING OF VIRTUAL PATH TO BE CLEARED

(13) DELETES FROM TABLE

(14) END

(15) SETS TIMER

A IDLE

FIG. 13 FLOW CHART OF CONDITIONAL CLEARING ACCORDING TO ANOTHER EMBODIMENT OF PRESENT INVENTION

A IDLE

(22) REQUESTS CLEARING OF VIRTUAL PATH

(21) TIMER IS UP

(23) TIME FROM TIME WHEN [THE VIRTUAL PATH] WAS USED LAST TO CURRENT TIME EXCEEDS THRESHOLD

(24) NOTIFIES CLEARING OF VIRTUAL PATH

(25) DELETES FROM TABLE

(26) PROCESSING END?

(27) SETS TIMER

A IDLE

FIG. 14 OPERATION OF ANOTHER EMBODIMENT OF PRESENT INVENTION

[LEFT TO RIGHT, TOP DOWN]

ATM NETWORK

A DATA

B VCI SETTING REQUEST

C TABLE SEARCHING

D VCI NOTICE

E CELL CELL CELL

F TIMER

A DATA

G TIME SETTING

G TIME SETTING

FIG. 15 OPERATION OF ANOTHER EMBODIMENT OF PRESENT INVENTION

[LEFT TO RIGHT, TOP DOWN]

ATM NETWORK

A DATA

B VCI NOTICE REQUEST

C TABLE SEARCHING

D VP SETTING

E TABLE SETTING

E TABLE SETTING

F VCI NOTICE

G CELL CELL CELL

A DATA

H TIME SETTING

H TIME SETTING

FIG. 16 OPERATION OF ANOTHER EMBODIMENT OF PRESENT INVENTION

[LEFT TO RIGHT, TOP DOWN]

ATM NETWORK

A TABLE INSPECTION

A TABLE INSPECTION

B VP CLEARING

C TABLE DELETE

C TABLE DELETE

FIG. 17 CONTROL BY HANDLER

VIRTUAL PATH

ATM NETWORK

62 HANDLER

FIG. 18 CONTROL BY TERMINAL DEVICE

ATM NETWORK

Continued from the top page

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DECLARATION

Chimoto Saito at 13-9, Makuharinishi 1-chome, Mihama-ku, Chiba-shi, Chiba 261-0026 Japan
declares:

(1) that he is a patent attorney;

(2) that he knows well both the Japanese and English languages;

(3) that he translated the above-identified Japanese Patent Application from Japanese to English;

(4) that the attached English translation is a true and correct translation of the above-identified Japanese Patent Application to the best of his knowledge and belief; and

(5) that all statements made of his own knowledge are true and that all statements made on information and belief are believed to be true.

August 26, 1999
Date 1999. 8. 26

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